which projects to regions of the hypothalamus, midbrain, pons, and medulla that are responsible for the expression of the various components of emotional responses. As we will see, activation of the central nucleus elicits a variety of emotional responses: behavioral, autonomic, and hormonal. (See Figure 11.2.)

The central nucleus of the amygdala is the most important part of the brain for emotional responses to aversive stimuli. When threatening stimuli are perceived, neurons in the central nucleus become activated (Pascoe & Kapp, 1985; Campeau et al., 1991). Damage to the central nucleus (or to the nuclei that provide it with sensory information) reduces or abolishes a wide range of emotional behaviors and physiological responses. After the central nucleus has been destroyed, animals no longer show signs of fear when confronted with stimuli that have been paired with aversive events. They also act tamer when handled by humans, their blood levels of stress hormones are lower, and they are less likely to develop ulcers or other forms of stress-induced illnesses (Coover et al., 1992; Davis, 1992; LeDoux, 1992). Monkeys typically show signs of fear when they see a snake, but those with amygdala lesions do not (Amaral, 2003). In contrast, when the central amygdala is stimulated, animals show physiological and behavioral signs of fear and agitation (Davis, 1992), people report feeling afraid (Gloor et al., 1982; Halgren et al., 1978; White, 1940), and long-term stimulation of the central nucleus produces stress-induced illnesses such as gastric ulcers (Henke, 1982). These observations suggest that the autonomic and endocrine responses controlled by the central nucleus are among those responsible for the harmful effects of long-term stress (see Chapter 18). Figure 11.3 summarizes the regions receiving information from the central amygdala and the responses they control.

EMOTIONAL CONDITIONING Some stimuli automatically activate the central nucleus of the amygdala and

Figure 11.2 Amygdala Projections

This figure shows a much-simplified diagram of the major divisions and connections of the amygdala that play a role in emotions.

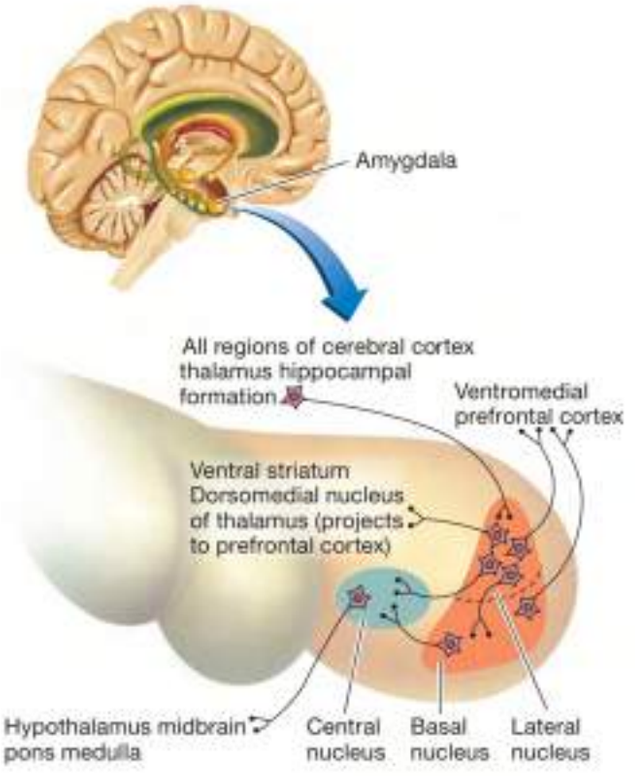

Figure 11.3 The Outputs of the Central Nucleus of the Amygdala

Shown here are some important brain regions that receive input from the central nucleus of the amygdala and the emotional responses controlled by these regions.

Adapted from Davis, M. (1992) The role of the amygdala in fear-potentiated startle: Implications for animal models of anxiety. *Trends in Pharmacological Sciences, 13,* 35–41.